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**Paving the Way Forward for Rural Finance**  
**An International Conference on Best Practices**

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**Case Study**

**Risk Management: Pricing, Insurance, Guarantees**

**The Use of Price and Weather Risk Management  
Instruments**

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All views, interpretations, recommendations, and conclusions expressed in this paper are those of the author (s) and not necessarily those of the supporting or collaborating institutions.

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### ***Constraints on Agricultural Lending***

Farmers face a spectrum of risks, and each of these risks -- along with how farmers manage them -- impact farm income, productivity, and access to credit. Farm level surveys have indicated that the most frequently cited risks are price, crop/weather and health. These risks among others could lower farmers' anticipated income and have negative effects on their standard of living, ability to provide for themselves and their families, ability to build capital, and ability to access credit from lenders.

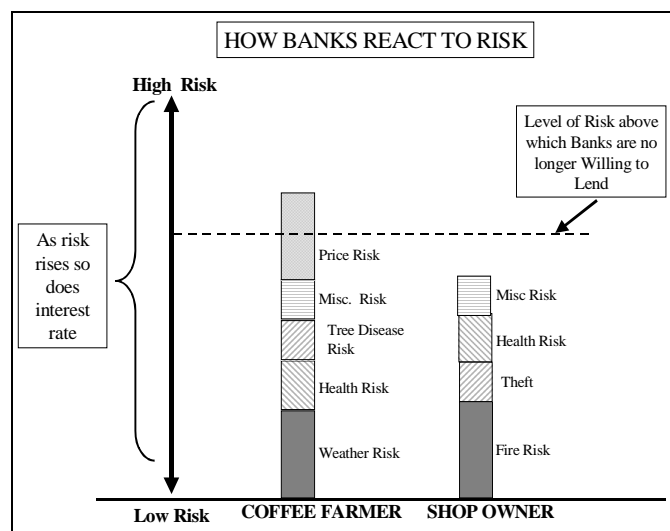
To deal with these risks, several countries have attempted to guarantee commodity prices and provide crop insurance and/or disaster relief. With regards to price risk, attempts to stabilize prices using stabilization funds and buffer stocks have defied market forces and resulted in unsustainable programs and substantial losses to treasuries.<sup>1</sup> With regard to yield risk, the traditional crop insurance approach has faced many problems in dealing with moral hazard, adverse selection and high administrative costs. In addition, traditional crop insurance often requires significant subsidies, which puts pressure on the government's fiscal situation. In order to mitigate price and yield risks at the farm level, producers often adopt low-risk and low-yield crop and production patterns to ensure a minimum income.<sup>2</sup> These production patterns come at the expense of high risk, high return production that could create income growth and the build-up of capital.

Lending institutions have looked for a variety of ways to expand their portfolio into agriculture but because of the risks associated with lending to farmers who lack traditional forms of collateral and face price falls and yield risk, these inroads have been limited. Many traditional arrangements that commercial banks and other financiers use to extend lending are not well suited on their own to provide lending to the agriculture sector. In lieu of private involvement in agricultural lending the state has often set up financing facilities (mainly in the form of state owned agricultural banks) at highly subsidized rates that often face very high default rates. It is often argued that this intervention is necessary because farmers are such poor risks (partly due to the unpredictable nature of agricultural prices and yields) that commercial credit institutions will not lend to them. It is an empirical question to determine to what extent price and weather/yield related risks impede or constrain lending for agricultural commodities, and it is expected that this determination be on a case-by-case basis. Nevertheless, some empirical evidence indicates that these are important risks that lenders for agriculture face.

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<sup>1</sup> The World Bank (2001).

<sup>2</sup> Ibid.



Source: CRMG, World Bank. "Commodity Price Risk Management for Producers, A Training Guide"

Smallholders and creditors alike would benefit from the mitigation of price and yield risk, thereby making some formerly un-creditworthy producers lending candidates.<sup>3</sup> This paper will discuss innovative ways to deal with both price and yield risk in order to give smallholders greater access to finance. It will discuss the use of market based price risk management tools such as futures and options to manage this risk and present a case study based on the work in Tanzania of the Commodity Risk Management Group at the World Bank. This paper will also discuss the use of weather risk management instruments and present a case study from Morocco on the use of these instruments as an alternative to traditional crop insurance.

### ***The Use of Market Based Price Risk Management Instruments in Mitigating Risk for Farmers and Lenders***

#### **Impact of Price Volatility on Farmers**

Price volatility significantly impacts the incomes of farmers and the macroeconomic health of their countries. From 1983-1998, the price of many commodities fluctuated from below 50 percent to above 150 percent of their average prices.<sup>4</sup> In the past many countries used marketing boards to guarantee farmers a minimum price for their production. But government policy that attempted to separate domestic commodity prices from international prices has proven financially unsustainable. With liberalization, many countries have abandoned marketing boards that were common to coffee, cocoa, and other import crops and thereby eliminated the smoothing effects this guaranteed minimum income had for farmers.<sup>5</sup>

In light of this, farmers are exposed to price fluctuations over the course of the season creating uncertainty about the price they will receive for their product when they take it

<sup>3</sup> Ibid.

<sup>4</sup> The World Bank (1999) p.5

<sup>5</sup> The World Bank (2001).

to be sold. At the farm level, this uncertainty in commodity prices makes it difficult for producers to allocate resources efficiently, limits their access to credit for productivity enhancing inputs, and leads them to adopt low-yield, low-risk production technologies, thereby lowering average incomes. At the macro level commodity price volatility affects government's fiscal revenues, trade balance, exchange rate, and creditworthiness.<sup>6</sup>

While market based tools (futures and options) that insulate producers from the negative effects of short-term price volatility are widely used in high-income countries, the vast majority of agricultural producers in developing countries are, in general, unable to access these markets. In lieu of these alternatives, farmers take steps to mitigate their own risks.<sup>7</sup> In the absence of markets for price hedging instruments, farmers try to cope with price risks by: (a) self-insuring through asset accumulation, savings, and access to credit (b) income diversification and (c) informal insurance arrangements. In most poor commodity dependent countries and for most poor farmers, credit and savings markets are imperfect and asset accumulation is never enough in times of a crisis. Diversification to other activities is difficult because farmers lack skills, information and capital to do something else. Many farmers adopt low-risk and low-yield crop and production patterns to ensure a minimum income. These production patterns come at the expense of perhaps riskier but higher return production that could create income growth and the accumulation of capital. Finally, informal insurance arrangements at the local community level often break down in the face of large systemic risks such as the collapse in commodity prices. The use of market based price risk management instruments to mitigate this price risk would provide farmers with new alternatives and allow them greater certainty in planning their on-farm activities and possibly provide greater access to credit.<sup>8</sup>

### **Impact of Price Risk Mitigation on Access to Credit**

Eliminating an important reason for non-repayment of loans, falling commodity prices, could substantially reduce the risk exposure of agricultural finance programs. The use of market based price instruments is likely to result in improved access to credit for small-scale producers and a healthier loan portfolio for creditors. Coupling price risk management instruments with a loan agreement lowers the risk of default that banks face because of falling commodity prices and substantially reduces transaction costs for the creditor and the borrowing producer. This type of joint product could serve to extend lending to producers who had not previously been deemed creditworthy, as well as, increase the average value of the loan because of the additional financing of the insurance premium, thereby, allowing better absorption of the creditor's fixed costs.<sup>9</sup>

Financial institutions could combine hedging with lending in three main ways: (a) hedging the exposure of their overall portfolio to commodity prices. This could allow

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<sup>6</sup> See Varangis, Larson and Yabuki (1998), and also Varangis, Larson and Anderson (2002) provide an extensive review of the literature about commodity price volatility and evolution of approaches and strategies to deal with it at both the micro and macro levels.

<sup>7</sup> For an extensive review of income risks, coping strategies and safety nets, for rural households in developing countries see Dercon, (2002)

<sup>8</sup> See for example Quattara et al (1990)

<sup>9</sup> The World Bank (2002).

financial institutions to restructure their portfolio, extend repayments, or even forgive part of the interest and/or principal repayments when a severe price shock occurs; (b) hedging on behalf of their borrowers, thus attaching a hedge to each loan; and (c) requiring that borrowers provide evidence of price protection when they come to negotiate a loan. A reasonable hypothesis is that banks will be able to expand their agricultural loan portfolios, and farmers will have better access to credit and/or opportunity to borrow at better terms. Microfinance institutions and credit unions may also prove feasible vehicles for delivery of price risk management instruments, and are likely to have better access to smallholder farmers.

### **The Implementation of Price Risk Management Programs**

While market based tools (futures and options) that insulate producers from the negative effects of short-term price volatility are widely used in high-income countries, the vast majority of agricultural producers in developing countries are, in general, unable to access these markets. Some traditional barriers to entry have prevented small holders from accessing these tools. The minimum size of contracts traded on organized exchanges far exceeds the annual quantity of production of individual small and medium-sized producers. In addition, small producers, as well as many market intermediaries in developing countries, lack knowledge of such market-based price insurance instruments and an understanding of how to use them. Finally, sellers of such instruments, generally international banks and brokerage houses, are often unwilling to engage with a new and unfamiliar customer base of small-scale producers, characterized by high transaction costs, diminished access to credit and performance risk.<sup>10</sup>

The World Bank -- with support from several donor governments, and in collaboration with international organizations and private sector representatives -- has been working as a facilitator, providing technical assistance and capacity building to allow producers in developing countries and local intermediary institutions with links to producers to access these instruments. To date seven transactions have been completed between developing country clients (in Uganda, Tanzania, and Nicaragua) and international providers (mainly major international banks in Europe and the US).

These transactions provided price protection for tonnages ranging from as low as 50 tons to as much as 700 tons. Transactions provided price protection for sales that were made as short period as one month in advance up to seven months in advance. The range of premiums paid for price protection varied from around 3% of the value of the commodity to as much as 8% with most transactions involving premium payment of around 4-6%.<sup>11</sup>

### **How Price Risk Management Instruments Work**

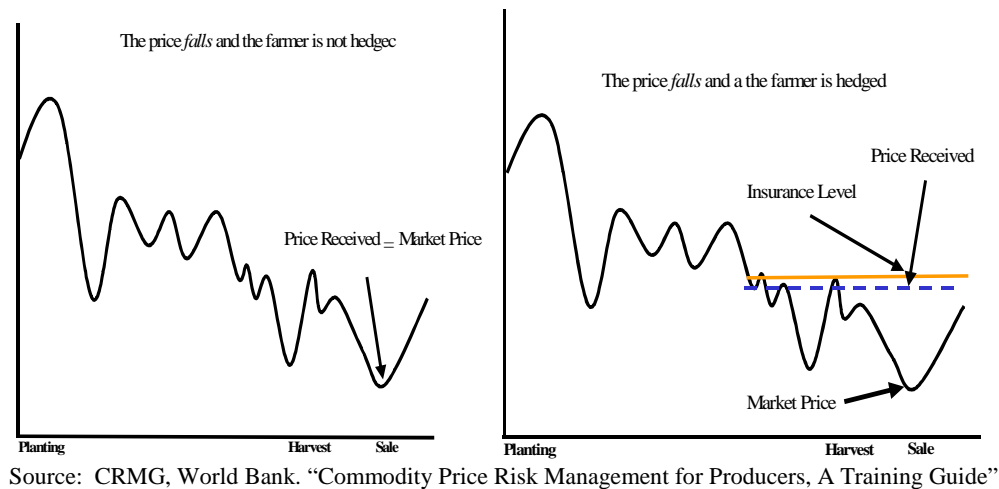
A parallel can be drawn between hedging instruments for price risk and typical insurance products. Producers' organizations, local banks, or exporters can purchase derivatives that are traded on international exchange (or based off these exchanges), in most cases a simple put option, on behalf of their producers. When combined with physical sales these financial instruments will guarantee a minimum price level based on an

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<sup>10</sup> Bryla, Varangis, and Tiffen (2003)

<sup>11</sup> Bryla, Varangis, and Tiffen (2003)

international price (not a local price) for a given commodity for a number of months. In order to purchase this financial product producers must pay a market related fee or a premium. In the case of put options, when price rises during the option contract period, the producer receives no payout from the contract but can still sell his physical product for the market price in order to benefit from the rising prices. However, when price falls during this period, the producer receives a payout equal to the difference between the price the producer chose to insure with the price risk management contract and the international market price on the last date of the option coverage.



Because of the size of these contracts it is necessary to aggregate producer demand for these products. A diversity of different types of organizations could serve this role as an intermediary. A domestic bank or other financial institution could integrate these products into its services.

### Case Study: The Story of Tanzania

In 2001 and 2002 coffee price fell to forty-year lows. Coffee is 20% of Tanzania's export earnings and this fall has affected over 400,000 low-income coffee households in Tanzania. The coffee sector in Tanzania was liberalized in 1993 and as a result there is competitive buying at the village level where coffee is purchased by both private traders and cooperatives. Liberalization has exposed farmers and their marketing organizations to price fluctuations over the course of the season which has made it difficult for farmers to optimize production technology, timing of sales, and use of assets that could eventually result in higher household incomes.<sup>12</sup> Exposure to price volatility coupled with absolute low prices for coffee has greatly diminished the overall welfare of coffee farmers.

While the long-term trend of declining prices cannot be stopped without some overall structural changes in the world coffee market, to confront the negative effects of short-term price volatility one of the largest coffee cooperatives in Tanzania has begun working with the World Bank to utilize price risk management instruments to hedge their price

<sup>12</sup> The World Bank (2002)

risk. This cooperative union has a large number of smallholder producer members whose average production is between 20- 100 kg per farmer.

Like many other cooperatives in Tanzania, the cooperative union utilizes a pricing system that consists of multiple payments to farmers throughout the year. Cooperative members receive a uniform minimum price for their coffee when they deliver it to the union, and then later in the season, depending on sales and market performance overall, farmers may receive subsequent payments for their product. The uniform minimum price, which is called the 1<sup>st</sup> payment, is established months in advance of the actual selling season and agreed at the annual general meeting of the producers. The guaranteed 1<sup>st</sup> payment is viewed as a service to the farmers and provides them with some form of price stability, but it can have disastrous financial impacts on the cooperative overall. If cooperatives guarantee a low 1<sup>st</sup> payment at the beginning of the season, they run the risk that market prices will rise and farmers will sell to traders instead of to the cooperative (local traders compete with the cooperatives by paying full market price for coffee, in cash, at the time of delivery of the product). If cooperatives guarantee a high 1<sup>st</sup> payment at the beginning of the season, they run the risk that market prices will fall, and they will make losses on the negative margin between purchase price to farmers and actual sales prices on the market. Since the 1<sup>st</sup> payment price is established well ahead of the selling season at a time when sales prices are not yet known, the cooperative union is essentially taking a long position on coffee, which is in effect from the time they set the 1<sup>st</sup> payment until the time they conclude all sales of coffee at the end of the season, a period which can stretch up to ten months.

There are other negative impacts of the 1<sup>st</sup> payment pricing system as well. In years past, in order to maintain the 1<sup>st</sup> payment price in the face of falling market prices during the sales period, the cooperative union would rely on premiums received for quality coffees with high positive differentials. This is proving not to be an effective strategy, however, since quality premiums are volatile and vary from season to season, and since the system creates disincentives for farmers to produce quality coffee. Because the union's policy is to pay the 1<sup>st</sup> payment price to all producers uniformly, those producers who sell quality coffee have very little incentive to sell to the cooperative. Any premium that the cooperative union does receive for sales of quality product is essentially diluted across all members to help guarantee the 1<sup>st</sup> payment and contribute to any subsequent payments.

For long-term survival and to assure continued financing year to year it was important for the cooperative union to develop new ways to manage a number of very difficult, sometimes conflicting goals, including:

- 1) Maintaining the tiered pricing system that gave farmer members a 1<sup>st</sup> payment price at the beginning of the season. This is considered to be a valuable service of the cooperative union, since the system provides price stability that helps farmers plan individual production and family budgets.
- 2) Finding a way to protect overall profitability from the often disastrous affects of setting 1<sup>st</sup> payment price high at the beginning of the season and having to sell low when prices fell later in the season.

- 3) Maintaining the union's ability to attract coffee supply large enough to meet forecasted sales obligations (i.e. not lose supply to traders).
- 4) Maintaining the union's ability to attract high quality coffee product in order to maximize high premium coffee sales.

In past years, the cooperative union had received funding for its operations at the beginning of the season in the form of a loan from a local commercial bank. Going forward, however, the loan agreements and the union's access to financing were in serious jeopardy due to a history of poor financial performance, which related in large part to the pricing problems described above. Since the coffee sector is very important to the economic and social structure of Tanzania, in the past the government had supported many of the cooperative unions through difficult times, but was indicating an impatience to continue doing so indefinitely.

The management of the cooperative union was determined to try to save the organization so that it could continue to provide services to its thousands of farmer members. Management began an aggressive export marketing drive and was able to improve the volume of export sales, which often receive Fair Trade prices and high quality premiums, but the majority of sales volume continued to be problematic and at risk. In order to assist the cooperative's own attempts to strengthen its marketing operations, the World Bank began working with the union to help it protect its prices with market-based hedging instruments.

The services provided by the World Bank's Commodity Risk Management Group consisted of technical assistance in the form of training and education about price risk management markets, principles, and products. The training with the cooperative union focused on four primary areas: 1) Global Markets, Activities, and Risk Management Products for Producers, 2) Risk Assessment and Design of Price Risk Management Program, 3) Membership Awareness and Adoption of Program 4) Account Opening and Mechanics of Trading.

Work with the cooperative union began in the summer of 2001 when the team provided the cooperative, the local bank and other players in the Tanzanian coffee sector with an overview of price risk management markets, instruments, and their application for producers. Information on the price risk management strategy was then distributed through society level training sessions administered by the cooperative staff. While these sessions did not get into details on options and derivatives markets, they did provide society leaders with a needed basic understanding of how hedging instruments work and the costs and benefits of using them. Once the union's management accepted the project it was presented at the annual general meeting for approval 1) to move forward with such a program and 2) to allocate funds to pay premiums for these instruments. After completion of this step, the project team provided more in-depth training, held collaborative work sessions with the management team, and proceeded with implementation. Using put options, the cooperative union designed a hedging strategy that matched its risk profile and was able to put in price floors on the international market

to protect against declining prices. The objectives of the strategy were to protect the union's break-even position and guarantee a 1<sup>st</sup> payment to farmers.

One of the main challenges associated with implementing this program was the opening of an account to trade with the international bank acting as provider<sup>13</sup>. It was initially assumed that once clients in developing countries had the technical skills to design a hedging strategy, it would take limited work to identify and establish a relationship with a provider. However, most providers of price risk management instruments are not completely prepared to transact with entities in developing countries, particularly with organizations of small-scale producers. A key issue for the providers was the need to prove knowledge of the client, including ensuring that the client understood the risk management products he/she was purchasing. Providers of financial products and services have intense due diligence requirements that include, among other things, the need to provide detailed information about ownership, structure, financial status, and trading history of the cooperative union. With anti-money laundering laws getting particularly stringent, this part of the process took on added importance, and a great deal of time. Eventually, the cooperative was approved as a new client and was able enter the market and hedge its price risk. The union took its first hedge position by buying a put option in October and it continued with market activity (which consisted of reselling the option when it no longer had exposure in a given month, and purchasing new option contracts to cover upcoming months) through the end of the selling season in March.

From the provider's perspective, the technical assistance provided by the Commodity Risk Management Group was critical. Without such technical assistance, private sector participants have indicated that they would not have been willing and able to transact with such new clients in developing countries. For the cooperative, although conclusive impacts of the risk management strategy are not yet entirely known since the season is just now ending, there were a number of positive affects:

- 1) The union improved its relationship with its local bank, which included a loan for premiums to cover the cost of hedging instruments in the total loan package given at the beginning of the year.
- 2) ***The union improved its overall financial state, including its debt position, and management of the union had a clear view of overall financial status throughout the season, without having to worry about the impact of prices falling below a certain level on the global market. They were able to communicate results with confidence to the local bank and government ministers who were monitoring progress.***
- 3) Improved financial transparency helped the union make better and more strategic selling decisions.
- 4) The union was able to pay farmers a 2<sup>nd</sup> and 3<sup>rd</sup> payment since there were periods of relatively higher market prices during some months of the selling season. In the past, any positive returns from high priced sales would have been held by the union until

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<sup>13</sup> Private sector providers here means the sellers of risk management instruments. They are generally international banks with commodity departments, but can also be commodity brokers or large multinational traders/processors.

the end of the season to protect against future losses. With hedging, the price floor created by the option allowed the union to disperse revenue at the time it was earned.

Each of the impacts listed above bodes well for the union's ability to continue to strengthen its relationship with its lenders and improve its access to credit. In a very short period of time, the union has moved from being a very high-risk enterprise to a much more stable operation. Price risk management has contributed to that growing stability and the union's managers have indicated that they are very pleased to have knowledge and access to such tools.

### ***The Use of Index- Based Yield Insurance in Mitigating Risk for Farmers and Lenders***

#### **Impact of Weather Risk on Farmers<sup>14</sup>**

While farm yields can be affected in a number of ways -- bad farming practices, shortage of labor, aging and diseased plants -- most of these things can be controlled for through proper farm management and agricultural technology. But the ability of farmers to mitigate the impact of weather events like droughts, floods, frosts and hurricanes, on their income is limited. Weather events are a pervasive characteristic of agricultural production. Some of the ways farmers deal with weather risk are similar to their mechanisms for dealing with price risk through activities such self-insurance, diversification and adoption of low risk-low return production practices, but farmers also undertake additional risk management practices such as irrigation and conservation tillage to protect soil and add moisture.

Weather risks are covariant and typically shock entire regions at once. If one farmer is suffering from some sort of weather problem it is likely that all of his neighbors are also. This makes it very difficult to set up local insurance schemes that have sufficient diversity in their portfolio to deal with the covariant risks. This bankrupts and makes ineffective "risk pools" and other local insurance schemes in the time of a weather crisis in a given area because all farmers must be paid at once.<sup>15</sup>

#### **Weather, Yield Risks, and Credit**

Limitations on agricultural lending are in large part due to the inability of farmers to control yields in light of possible weather events. By nature weather events are generally hard to predict and can be devastating to a farmers anticipated income and ability to repay debts. Because of this unpredictability banks are hesitant to lend to farmers who could suffer losses due to weather. Weather risk, like price risk, has been one of the justifications for supporting state owned agricultural banks to provide lending to farmers. Some developed and developing countries have adopted crop insurance programs to deal with yield variations identifying crop insurance as a way to protect agricultural credit. In many cases, banks have linked crop insurance policies to the farmers' credit requests. Brazil, India, Mexico and Morocco, among few other developing countries, have tried to link agricultural credit to some form of yield insurance, usually traditional crop

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<sup>14</sup> This section draws heavily on Hess, Richter, and Stoppa, (2002)

<sup>15</sup> See Skees et. al. (2002).

insurance. However, traditional crop insurance has several problems including moral hazard, adverse selection and high administrative costs.<sup>16</sup> These problems are much higher when it comes to small producers in developing countries, with weak information systems, lack of experience in insurance and weak financial/insurance institutions. Because of the problems with traditional crop insurance, many of these efforts linking credit to insurance have encountered serious limitations (e.g. limited coverage) and high costs. Governments and local private companies are looking into new approaches for linking credit to some form of output or weather insurance.<sup>17</sup>

### **How Weather-Based Index Based Insurance Works**

Risk management products based on weather events avoid the problems of traditional crop insurance because they rely on objective observations of specific weather events that are outside the control of either farmers or insurance companies. They are also less costly to administer because they do not require individual contracts and on-field inspections and loss adjustments. Although these are often called weather-based index insurance products, they are strictly risk management tools rather than traditional insurance.

Weather-based index insurance compares a measurable, objective, correlated risk (e.g. rainfall, temperature, windspeed, etc) to yields. In the case of rainfall as the correlated risk, historical data gathered from regional weather stations is used to determine the mean rainfall for a given period in the farmer's area. Once the appropriate period has been selected, the issue becomes structuring the rainfall index.<sup>18</sup>

A weather (rainfall) "index" should be carefully designed to weight the more important periods for rainfall in the crop cycle more heavily and than those periods where rainfall is not as important to production. Precipitation in different stages contributes in different measures to plant growth and an excess of rain may be of no use for production. Hence, it is useful to develop a weighting system that allows to differentiate the importance of rainfall in different growth periods and to shape the model so as to take into account the fact that excess rain may be wasted without contributing to plant growth. The final value of the index (the value which, when compared with the threshold, indicates if the insured should be granted an indemnity or not) is calculated by summing the values obtained by multiplying rainfall levels in each period by the specific weight assigned to the period.<sup>19</sup>

Once a sufficient degree of correlation is established between rainfall and yield, and the index has been weighted properly an agricultural producer can hedge his production risk by purchasing a contract that pays in the case rainfall falls below a certain threshold. Farmers can elect coverage for a given period taking into consideration the crop cycle and the marketing cycle. Using this historical index the program is designed as a European put where the option premium is the cost of the coverage and the strike is the

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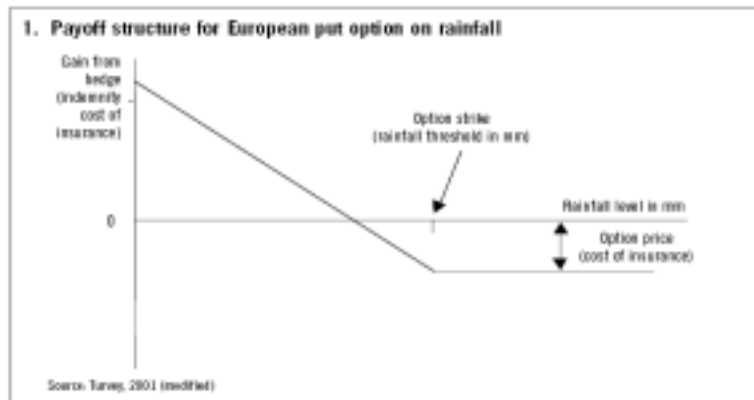
<sup>16</sup> See Hazell, (1992)

<sup>17</sup> See Skees, Hazell and Miranda, (1999)

<sup>18</sup> In addition to weather events as the basis of the index, insurance can be written on area yields (e.g. county yields). However, the use of area yields as an index requires adequate and reliable historical observations and the trust that future area yield estimates will not be manipulated.

<sup>19</sup> Hess, Richter, and Stoppa, (2002)

rainfall threshold below which indemnity is triggered. The insurance is set up on a proportional basis allowing farmers to choose their rainfall trigger level or threshold.<sup>20</sup>



Customers participating receive a payment if the rainfall index level falls below the threshold. The higher the threshold set for the contract the better the coverage provided, the trade off being the higher the threshold the higher the cost of the coverage. In essence a farmer can elect a lower trigger amount of rainfall in order to lower his premium or he can elect a much higher trigger that will give him greater protection but will cost more in premium. Customers can also elect the comprehension of their insurance so they can partially or fully insure their revenue.

Their payment from the insurance is ultimately determined by the combination of these two factors -- the rainfall threshold that they wish to be their trigger and the comprehensiveness of the coverage they want. Payment is equivalent to the percentage of rainfall-index shortage multiplied by the level of coverage selected. In the case where rainfall does not fall below the trigger no payment is made to the farmer and the premium is not returned.

### **Case Study: The Risk of Drought for Moroccan Grains<sup>21</sup>**

Agriculture accounts for 17% of the Moroccan GDP while most of the poor live in rural areas. Seventy percent of all agricultural lands are in cereals and as a result the Moroccan government has a keen interest in insuring the revenue from this crop. The yield of this cereal production is highly correlated with the amount of rainfall in a given year (90% of agriculture is non-irrigated) and drought is the single most determining factor in crop failure. While 50% of this land under cereal production lies in favorable zones in terms of weather, the other 50% lies in less favorable zones. The government has price controls for the sale of cereals and has been attempting to develop a weather risk insurance in order to protect its farmers and allow them to access credit for pre-harvest finance.

<sup>20</sup> *ibid.*

<sup>21</sup> See Skees, et al (2001)

Farmers in Morocco exposed to drought have over time adopted strategies to cope with this risk. Examples are water conservation, use of drought-resistant seeds, diversified farming systems, food storage, use of livestock, and the development of off-farm sources of income. In particular, several studies, in addition to field visits, have indicated that there is a high dependence on off-farm income to sustain small farm households. Livestock (mainly sheep) also play an important role in drought risk reduction, although farmers often complain that they have to sell their livestock in difficult times when prices are lower.<sup>22</sup>

There are also differences among zones in the strategies used to deal with drought. In less favorable areas (rainfall of approximately 200-400 mm), a common practice is to adopt low input application, increasing input application only when climatic (rain) conditions appear favorable. This strategy has the impact of lowering potential yields. Farmers in these areas also tend to use local varieties of seeds most resistant to drought, without regard to their other qualities. Farmers are thus using the seeds that have the lowest yields and which are least responsive to fertilizers. In the favorable areas in the northwest of the country, farmers use a higher input technology as they have a greater certainty of achieving an acceptable return. The use of insurance can provide financial security to farmers to survive until the next crop season, but should not encourage high risk cropping, adoption of inappropriate technologies or expansion of production into inappropriate lands.<sup>23</sup>

### **Effects of Drought on Agricultural Lending in Morocco**

The Moroccan government first implemented a traditional crop insurance program in 1995. This “drought insurance” program, “Programme secheresse” (drought plan), was enacted as a yield insurance program where an indemnification by insurers to farmers was triggered by a ministerial declaration of official drought. This approach proved too costly to maintain and did not provide the type of coverage best suited for producers. The ministerial declaration of drought at a national level was far too broad to account for more micro-level weather events that negatively impacted yield at a very regional level. In addition this “drought declaration” was subject to political influence and pressure.

The development of drought insurance in Morocco is closely linked to rural credit, in particular as a means of reducing the exposure of *Caisse Nationale de Crédit Agricole* (CNCA, the public agricultural bank) to climatic risks. Although there has not been a formal study of the link between drought and loan delinquency, an important issue in Moroccan agricultural policy has been the government’s forgiveness of farm loans following drought. It could be argued that borrowers’ expectations of debt relief may have contributed to their reluctance to repay loans. It has therefore been recognized that the development of formal drought insurance could help improve borrower repayment discipline by diminishing farmers’ inability to repay following a drought.

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<sup>22</sup> Hess, Richter, and Stoppa, (2002)

<sup>23</sup> *ibid.*

CNCA finances about 11 percent of loans to the Moroccan economy and more than 80 percent of all loans to the agricultural sector. Although most of CNCA's lending is agricultural, almost one-third of its total portfolio is composed of non-agricultural loans. Over the past several years, CNCA's financial position has been weak, with a high level of non-performing loans, under-provisioning, and operating losses. In 1997, the bank was restructured and new management was brought in to work to correct these problems, but—due in part to the negative effect of severe, successive droughts since the reorganization—significant progress has not yet been achieved.

In 1999, CNCA made the purchase of drought insurance a mandatory condition for obtaining an agricultural loan in the areas covered under the current drought insurance scheme. This requirement is widely credited with the increase in insurance subscriptions, but it is not known if the cost of this mandatory insurance contributed to the significant drop in the number of CNCA borrowers (from 287,941 in 1998 to 194,093 in 1999). Ideally, an insurance product would be a tool not only to protect CNCA's loan repayment but also to help ensure that financially viable farmers have access to credit.

The Moroccan government has incurred significant fiscal costs in its support of CNCA and agricultural lending, but also for general drought relief. However, in addition to these, the catastrophic drought of the 1999-2000 crop year led the government to announce a massive relief program. Over an 18-month period, the government spent significant resources on drought relief to protect livestock and forests as well as provide water for villages and herds in drought-stricken areas. Given the significant costs of providing drought relief to farmers and supporting CNCA's financial viability, the Moroccan government has expressed strong interest in finding cost-effective ways to aid farmers in managing their drought risk and improving their ability to repay agricultural loans consistently.

### **Implementation of a Weather Index Insurance Pilot Program in Meknes**

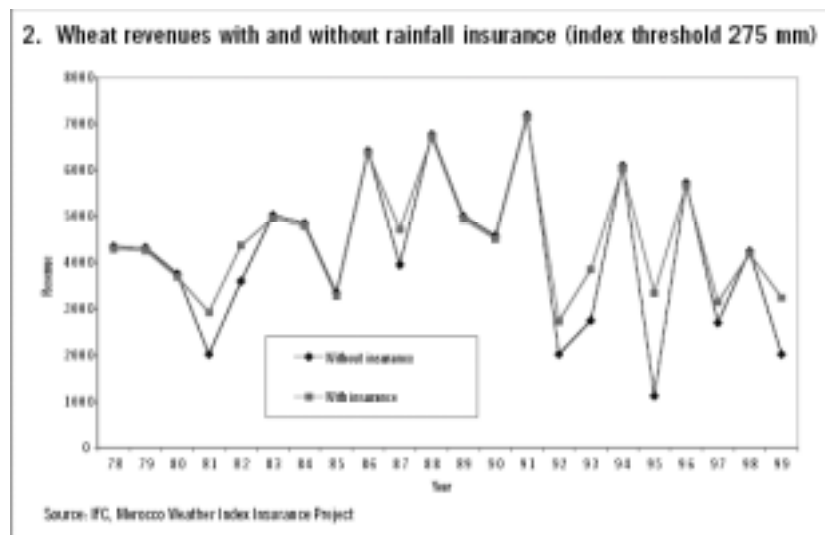
As a result the Moroccan government is looking into index based weather insurance to provide a safety net for these weather events while at the same time eliminating the high transactions costs and moral hazard/adverse selection problems associated with traditional crop insurance. Following a World Bank feasibility study, The International Finance Corporation, CNCA, and the Moroccan mutual agricultural insurance company (MAMDA), have begun joint efforts to implement an index based weather risk program in Morocco.

The work was undertaken to determine if weather insurance would be useful in the Moroccan context by exploring the correlation between rainfall and cereal revenue. Production yield and rainfall data, from the National Meteorological Society, was collected. Specific rainfall indexes were constructed assigning "weights" to different rainfall periods in order to maximize correlation between yields and rainfall. Based on historical data the correlation between rainfall and cereal revenue is sufficiently strong in 17 provinces. In order to structure the index, trends in yield and rainfall series were examined, rainfall for each synoptic station aggregated in 10-day periods and weights assigned through a mathematical programming procedure that maximizes correlation between yields and the rainfall index.

Based on this structured index the first pilot will be in the Meknes region and has been designed to insure 5000 hectares of cereal against drought. Two consecutive major droughts in 2000/2001 and 2001/2002 lowered the 5-year moving average rainfall significantly. Therefore a reasonable coverage of around 80% of the long-term mean was very close to the 5-year average. This uncertainty about the rainfall trend led international weather insurance companies to impose high “load” premiums in addition to the pure risk premium that was based on historical data. As a result the government is considering subsidizing part of the premiums of this program. In this case weather insurance is still costly but will likely be less costly and more efficient than the current “garantie secheresse” (drought guarantee) program.

A feature of the Moroccan rainfall insurance program is the link to crop loans by the State Agricultural Bank, CNCA. Agricultural producers need resources for anticipating cultivating costs and part of the loan granted to the farmer can be devoted by the credit institution to financing the insurance coverage. This marketing procedure will certainly help the development of the program, in its infant stage, at the same time granting revenue coverage to the producer and reducing default risk for credit institutions.

This pilot is still in the implementation phase with some aspects of its design being solidified, therefore, no results can be provided to date. But what can be evaluated is the impact this insurance would have had on past crop seasons. Figure 2 provides a graphical description of the past performance if a rainfall index insurance had been in place for wheat production for a specific synoptic station of Morocco. The figure represents the different level of wheat revenue with or without rainfall insurance. It should be noted that the insurance program prevents revenues from falling below a threshold of approximately Dh3,000 (approximately US\$300).



Several different alternatives, all aimed at making the coverage as extended and as comprehensive as possible, were evaluated by the IFC research team for the pilot program. Overall however, the simplicity of the rainfall index and the comparatively

lower cost of the coverage led to the selection of the simple proportional rainfall index as the preferred model for implementation in Morocco.

### ***Other Innovations***<sup>24</sup>

Price and weather risk management improve the certainty of borrowers' cash flow and ensure that they will be able to repay the loan in cases of severe weather events and collapse in international prices for a commodity. If risk management contracts are endorsed to banks and rural financial institutions, then they can be a form of "liquid" collateral. Another form of liquid collateral which could improve the "creditworthiness" of farmers for banks and other financial institutions is the use of warehouse receipts. Warehouse receipts can prove to be a good collateral after the goods are produced and deposited in a secure warehouse. Banks can lend using commodities in the warehouse as a collateral because in the case of loan default, banks have access to the goods that can sell and recover the loan. Security of the warehouse facilities and appropriate legal and regulatory environment are usually needed for commodities to be a safe collateral in warehouses. Currently in the Mexican sugar sector millers have begun relying on a "reverse repurchase transactions" or *reportos* to obtain lending from their commercial banks. These millers, in a sector that supports 3 million people, are the primary source of financing for producers and require a certain amount of working capital to maintain their operations.

In this *reporto* scheme, millers deposit in a certified third party warehouse an amount of sugar of equivalent value to the loan they wish to take out. The warehouse then issues certificates of deposit and bonds to the bank for the sugar for up to 80% of its value. While this looks like a typical warehouse receipts scheme it is somewhat unique in that the bank takes complete ownership of the sugar when it is placed in the warehouse. Instead of just certifying the quantity of sugar in the warehouse, this *reporto* scheme gives the bank ownership of the sugar until the miller pays back the loan. The sugar is marked to the market and if the market moves and the value of the sugar diminishes by more than 5% the miller is required either to deposit more sugar in the warehouse (while at the same time selling it to the bank) or return the part of the loan. If the sugar increases in value the miller will not necessarily receive an increased loan amount. Also, because millers typically borrow in groups, all considers a default by one miller a default.

### ***Conclusions***

Price and weather insurance can both act as types of "liquid collateral" for banks. This liquid collateral in the case of price risk would be a financial product and in case of weather it would be an insurance product. These instruments on their own can help improve the creditworthiness of small farmers but the combination of these two types of guarantees and possibly in combination with a warehouse receipts program could provide a more comprehensive income insurance for producers.<sup>25</sup> The effect of this combination would also provide banks and other financial institutions the opportunity to take on far

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<sup>24</sup> Information on Reportos was obtained from a presentation by Latin America Capital LLC.

Berry, Henry. "Sugar Financing in Mexico", Day Robinson Sixth Global Meeting on Warehouse Receipt Finance and Collateral Control in Latin America, Miami, February 25-26, 2003.

<sup>25</sup> World Bank (2002).

less risk when lending to farmers. As financial institutions look to expand their portfolio into agricultural markets and, particularly rain fed agriculture, it must be determined how their financial services can be enhanced and expanded upon to make them suitable for use in the agricultural setting. Innovations like market based price risk management and index-based yield insurance are two innovations that can be used to improve the ability of financial institutions to offer their services to agricultural producers.

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